Chapter 2

Current Emissions and Air Quality -- Criteria Pollutants

Introduction

This chapter provides statewide information on current emissions and air quality, relative to the State and national ambient air quality standards (see Chapter 5 for information on toxic air contaminants). This section gives a national perspective on how California's air quality compares with that in other areas of the nation. The second section of this chapter includes a summary table of the Statewide Emission Inventory. The table shows emissions data by four major source categories: stationary sources, area-wide sources, mobile sources, and natural sources. The third section provides more detailed information for the four major source categories in a table of the Statewide Emission Inventory by sub-category. The remaining sections of this Chapter provide information on emissions (including the high emitting facilities) and air quality on a statewide basis. This information is organized by pollutant, for ozone (and ozone precursor emissions), particulate matter (PM_{10} and $PM_{2.5}$), and CO.

Emissions are reported as annual averages, in tons per day. For most sources and pollutants that are not seasonal, this describes emissions very well. However, for some pollutants such as PM_{10} and $PM_{2.5}$, annual averages do not give an accurate indication of the seasonal nature of emissions. Therefore, they may appear to be artificially low. Many sources of PM_{10} and $PM_{2.5}$ are seasonal, including wildfires, seasonal operations such as agricultural processes, or dust storms in the Owens Valley and Mono Lake areas. Many sources of PM_{10} and $PM_{2.5}$ can also be very localized, and basinwide annual averages do not give any information about these sources.

State and local agencies have implemented many control measures during the last three decades to improve air quality. As a result, there has been a steady decline in both emissions and pollutant concentrations. However, three criteria pollutants, ozone, particulate matter, and carbon monoxide, still pose air quality problems. Existing control programs have substantially reduced ambient CO concentrations. During 2001, CO concentrations were below the levels of the standards in all areas except Calexico. In contrast, it will be a significant challenge to reduce emissions sufficiently to attain the ozone and PM standards statewide.

Figure 2-1 shows the national 1-hour ozone design values for the top 15 urban areas in the nation, based on data for 1999 to 2001. The design values in all these areas exceed the national 1-hour standard of 0.12 ppm. Five of the top fifteen areas are located in California, with the Los Angeles South Coast Air Basin and Imperial County areas ranking second and third. Unlike previous years, the top spot is not held by a California area. However, the ranking of areas can change, depending on the ozone statistic used. For example, based on the average estimated exceedance rate during 1999 to 2001, the Los Angeles area would rank first (24.9 days) while the Houston-Galveston-Brazoria, Texas area would rank second (11.2 days). Overall, as ozone concentrations in California decline, our air quality continues to improve relative to other areas of the nation.

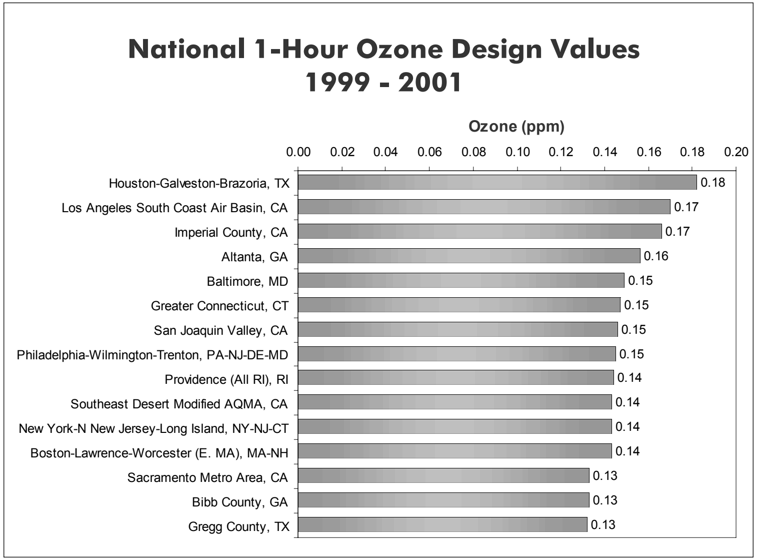
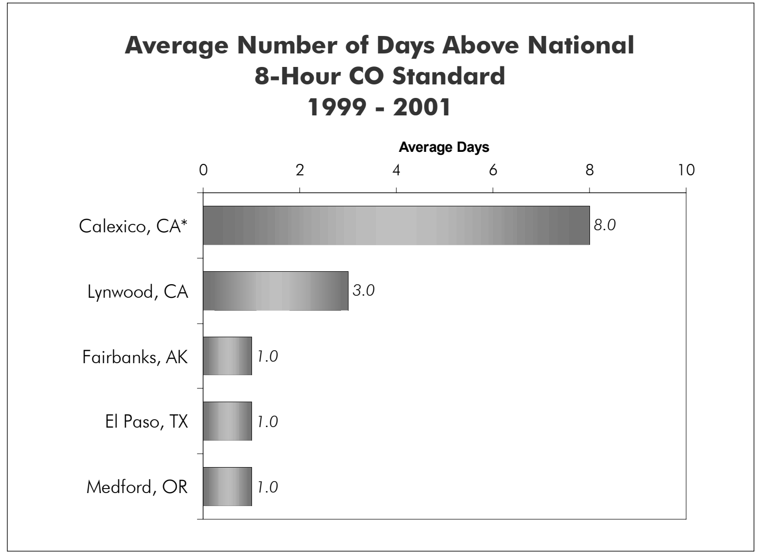


Figure 2-1

Attainment of the standards for particulate matter (PM_{10} and $PM_{2.5}$) is also a significant problem. The PM_{10} problem is most prevalent in the western United States. Eight western areas are classified as serious PM_{10} nonattainment areas. Half of these, the Coachella Valley, the Owens Valley, the San Joaquin Valley, and the South Coast Air Basin, are located in California. In contrast, the $PM_{2.5}$ problem is most prevalent in both the eastern United States and in California. Because of the complex nature of the particulate matter problem, it will be many years before the standards are attained.

Carbon monoxide (CO) poses much less of a problem. Figure 2-2 shows the five areas in the nation that averaged at least one day with CO concentrations above the level of the national standard during 1999 to 2001. The Calexico (Imperial County) and Lynwood (Los Angeles County) areas rank first and second. While these two areas are the only ones in California where the CO standards are still violated, the State's stringent motor vehicle emission standards and clean fuels programs continue to be effective in reducing ambient CO concentrations. Furthermore, as a result of these controls, CO concentrations in nine other California areas no longer violate the national standards, and these areas have been redesignated as attainment.



* Calexico does not include data for 2001

Figure 2-2

2002 Statewide Emission Inventory Summary

Division Major Category	TOG	ROG	CO	NOx	SOx	PM_{10}*	$PM_{2.5}$*
	Emissions (tons/day, annual average)						
Stationary Sources	2535	538	441	610	136	135	88
Fuel Combustion	215	49	361	501	50	42	37
Waste Disposal	1447	23	2	3	1	1	1
Cleaning And Surface Coatings	344	237	0	0	0	0	0
Petroleum Production And Marketing	450	164	13	13	53	3	2
Industrial Processes	79	65	65	94	32	89	48
Area-Wide Sources	2027	698	2085	93	5	1873	583
Solvent Evaporation	521	463	0	0	0	0	0
Miscellaneous Processes	1506	235	2085	93	5	1873	583
Mobile Sources	1530	1406	12101	2694	88	118	97
On-Road Motor Vehicles	1019	938	9372	1728	13	48	33
Other Mobile Sources	511	467	2730	966	75	70	64
Natural Sources**	106	38	409	18	0	80	71
Total Statewide - All Sources	***6198***	***2680***	***15036***	***3415***	***228***	***2206***	***839***

* Includes directly emitted particulate matter only.
** Does not include biogenic sources. These summaries do not include emissions from wind blown dust - exposed lake beds from Owens and Mono Lakes. These emissions are estimated to be about 800 tons/day.

Table 2-1

2002 Statewide Emission Inventory by Sub-Category

Division Major Category Sub-Category	Emissions (tons/day, annual average)						
	TOG	ROG	CO	NOx	SOx	PM_{10}*	$PM_{2.5}$*
Stationary Sources (division total)	**2535**	**538**	**441**	**610**	**136**	**135**	**88**
Fuel Combustion (major category total)	215	49	361	501	50	42	37
- Electric Utilities	31	5	68	62	5	6	6
- Cogeneration	19	5	45	31	2	4	4
- Oil And Gas Production (Combustion)	41	9	24	35	9	2	2
- Petroleum Refining (Combustion)	2	1	17	43	14	3	3
- Manufacturing And Industrial	59	8	69	131	13	7	7
- Food And Agricultural Processing	5	4	53	41	3	4	4
- Service And Commercial	47	9	48	81	3	5	5
- Other (Fuel Combustion)	10	6	37	76	1	10	7
Waste Disposal (major category total)	1447	23	2	3	1	1	1
- Sewage Treatment	1	1	0	0	0	0	0
- Landfills	1416	18	1	0	0	0	0
- Incinerators	0	0	1	2	0	0	0
- Soil Remediation	0	0	0	0	0	0	0
- Other (Waste Disposal)	30	4	0	0	-	0	0
Cleaning And Surface Coatings (major category total)	344	237	0	0	0	0	0
- Laundering	7	1	0	0	-	-	-
- Degreasing	141	56	-	-	-	-	-
- Coatings And Related Process Solvents (sub-category total)	145	134	0	0	0	0	0
- Auto Marine, & Aircraft	*24*	*23*	*0*	*0*	*0*	*0*	*0*
- Paper & Fabric	*4*	*3*	*0*	*0*	*0*	*0*	*0*
- Metal, Wood, & Plastic	*44*	*42*	*0*	*0*	*0*	*0*	*0*
- Other	*73*	*66*	*0*	*0*	*0*	*0*	*0*

* Includes directly emitted particulate matter only.

Table 2-2

2002 Statewide Emission Inventory by Sub-Category

Division Major Category Sub-Category	TOG	ROG	CO	NOx	SOx	PM_{10}*	$PM_{2.5}$*
Stationary Sources (division total) (continued)							
Cleaning And Surface Coatings (major category) (continued)							
- Printing	19	19	0	0	-	0	0
- Adhesives And Sealants	25	22	-	-	-	0	-
- Other (Cleaning And Surface Coatings)	7	5	0	0	-	0	0
Petroleum Production And Marketing (major category total)	450	164	13	13	53	3	2
- Oil And Gas Production	116	54	1	3	0	0	0
- Petroleum Refining	32	25	11	10	52	2	2
- Petroleum Marketing (sub-category total)	301	84	1	0	-	0	0
- Fuel Distribution Losses	*219*	*4*	*1*	*0*	*0*	*0*	*0*
- Fuel Storage Losses	*5*	*5*	*0*	*0*	*0*	*0*	*0*
- Vehicle Refueling	*50*	*50*	*0*	*0*	*0*	*0*	*0*
- Other	*27*	*26*	*0*	*0*	*0*	*0*	*0*
- Other (Petroleum Production And Marketing)	0	0	-	-	-	-	-
Industrial Processes (major category total)	79	65	65	94	32	89	48
- Chemical	28	23	0	2	3	4	4
- Food And Agriculture	22	20	3	10	2	15	6
- Mineral Processes	6	5	49	60	20	47	22
- Metal Processes	2	1	2	1	0	1	1
- Wood And Paper	4	4	1	3	1	10	7
- Glass And Related Products	0	0	0	12	6	2	1
- Electronics	1	1	0	0	-	0	0
- Other (Industrial Processes)	16	11	10	7	1	9	6

Emissions (tons/day, annual average)

* Includes directly emitted particulate matter only.

Table 2-2 (continued)

2002 Statewide Emission Inventory by Sub-Category

Division Major Category Sub-Category	Emissions (tons/day, annual average)						
	TOG	ROG	CO	NOx	SOx	PM_{10}*	$PM_{2.5}$*
Area-Wide Sources (division total)	**2027**	**698**	**2085**	**93**	**5**	**1873**	**583**
Solvent Evaporation (major category total)	521	463	0	0	0	0	0
- Consumer Products	320	267	-	-	-	-	-
- Architectural Coatings And Related Process Solvent (sub-category total)	118	114	-	-	-	-	-
- Architectural Coating	*101*	*98*	*0*	*0*	*0*	*0*	*0*
- Thinning & Cleanup Solvents	*17*	*16*	*0*	*0*	*0*	*0*	*0*
- Pesticides/Fertilizers (sub-category total)	52	52	-	-	-	-	-
- Farm Use	*49*	*49*	*0*	*0*	*0*	*0*	*0*
- Commercial Use	*3*	*3*	*0*	*0*	*0*	*0*	*0*
- Asphalt Paving / Roofing	31	31	-	-	-	0	0
Miscellaneous Processes (major category total)	1506	235	2085	93	5	1873	583
- Residential Fuel Combustion (sub-category total)	127	56	816	77	4	118	114
- Wood Combustion	*120*	*53*	*791*	*10*	*2*	*113*	*109*
- Cooking And Space Heating	*6*	*2*	*21*	*57*	*2*	*4*	*4*
- Other	*1*	*0*	*4*	*10*	*0*	*1*	*1*
- Farming Operations (sub-category total)	1236	99	-	-	-	161	34
- Tilling,Harvesting, & Growing	*0*	*0*	*0*	*0*	*0*	*142*	*32*
- Livestock	*1236*	*99*	*0*	*0*	*0*	*19*	*2*

* Includes directly emitted particulate matter only.

Table 2-2 (continued)

2002 Statewide Emission Inventory by Sub-Category

Division Major Category Sub-Category	TOG	ROG	CO	NOx	SOx	PM_{10}*	$PM_{2.5}$*
	Emissions (tons/day, annual average)						
Area-Wide Sources (division total) (continued)							
Miscellaneous Processes (major category) (continued)							
- Construction And Demolition (sub-category total)	-	-	-	-	-	189	39
- Building	*0*	*0*	*0*	*0*	*0*	*109*	*23*
- Road Construction Dust	*0*	*0*	*0*	*0*	*0*	*80*	*17*
- Paved Road Dust	-	-	-	-	-	407	79
- Unpaved Road Dust	-	-	-	-	-	542	115
- Fugitive Windblown Dust (sub-category total)	-	-	-	-	-	305	66
- Farm Lands	*0*	*0*	*0*	*0*	*0*	*172*	*38*
- Pasture Lands	*0*	*0*	*0*	*0*	*0*	*19*	*4*
- Unpaved Roads	*0*	*0*	*0*	*0*	*0*	*114*	*24*
- Fires	1	1	10	0	-	1	1
- Waste Burning And Disposal (sub-category total)	134	74	1258	15	1	125	116
- Agricultural Burning	*33*	*19*	*210*	*5*	*0*	*25*	*24*
- Non-Agricultural Burning	*101*	*55*	*1048*	*10*	*0*	*100*	*92*
- Other	*0*	*0*	*0*	*0*	*0*	*0*	*0*
- Cooking	8	6	-	-	-	25	19
- Other (Miscellaneous Processes)	0	0	2	0	-	1	1

* Includes directly emitted particulate matter only.

Table 2-2 (continued)

2002 Statewide Emission Inventory by Sub-Category

Division Major Category Sub-Category	Emissions (tons/day, annual average)						
	TOG	ROG	CO	NOx	SOx	PM10*	PM2.5*
Mobile Sources (division total)	**1530**	**1406**	**12101**	**2694**	**88**	**118**	**97**
On-Road Motor Vehicles (major category total)	1019	938	9372	1728	13	48	33
- Light Duty Passenger (sub-category total)	490	453	4199	401	3	17	9
- Non-Evaporative	*295*	*259*	*4197*	*398*	*3*	*16*	*9*
- Evaporative	*194*	*194*	*0*	*0*	*0*	*0*	*0*
- Diesel	*1*	*1*	*2*	*3*	*0*	*0*	*0*
- Light Duty Trucks(<3750 lbs.) (sub-category total)	167	155	1745	161	1	5	3
- Non-Evaporative	*103*	*90*	*1743*	*156*	*1*	*4*	*2*
- Evaporative	*64*	*64*	*0*	*0*	*0*	*0*	*0*
- Diesel	*1*	*1*	*3*	*5*	*0*	*0*	*0*
- Light Duty Trucks (>3750 lbs) (sub-category total)	130	119	1378	179	1	6	4
- Non-Evaporative	*86*	*75*	*1377*	*177*	*1*	*6*	*4*
- Evaporative	*44*	*44*	*0*	*0*	*0*	*0*	*0*
- Diesel	*0*	*0*	*1*	*2*	*0*	*0*	*0*
- Medium Duty Trucks (sub-category total)	71	65	707	103	1	3	2
- Non-Evaporative	*49*	*43*	*706*	*101*	*1*	*3*	*2*
- Evaporative	*21*	*21*	*0*	*0*	*0*	*0*	*0*
- Diesel	*0*	*0*	*1*	*3*	*0*	*0*	*0*
- Light Heavy Duty Gas Trucks (<10000 lbs) (sub-category total)	28	26	177	17	0	0	0
- Non-Evaporative	*17*	*15*	*177*	*17*	*0*	*0*	*0*
- Evaporative	*11*	*11*	*0*	*0*	*0*	*0*	*0*
- Light Heavy Duty Gas Trucks (>10000 lbs) (sub-category total)	5	5	40	6	0	0	0
- Non-Evaporative	*3*	*3*	*40*	*6*	*0*	*0*	*0*
- Evaporative	*2*	*2*	*0*	*0*	*0*	*0*	*0*
- Medium Heavy Duty Gas Trucks (sub-category total)	32	30	245	22	0	0	0
- Non-Evaporative	*23*	*21*	*245*	*22*	*0*	*0*	*0*
- Evaporative	*9*	*9*	*0*	*0*	*0*	*0*	*0*

* Includes directly emitted particulate matter only.

Table 2-2 (continued)

2002 Statewide Emission Inventory by Sub-Category

Division Major Category Sub-Category	TOG	ROG	CO	NOx	SOx	PM10*	PM2.5*
	Emissions (tons/day, annual average)						
Mobile Sources (division total) (continued)							
On-Road Motor Vehicles (major category) (continued)							
- Heavy Heavy Duty Gas Trucks (sub-category total)	23	21	307	47	0	0	0
- Non-Evaporative	*20*	*17*	*307*	*47*	*0*	*0*	*0*
- Evaporative	*4*	*4*	*0*	*0*	*0*	*0*	*0*
- Light Heavy Duty Gas Trucks (<10000 lbs)	1	1	2	17	0	0	0
- Light Heavy Duty Gas Trucks (>10000 lbs)	1	1	2	15	0	0	0
- Medium Heavy Duty Diesel Trucks	4	4	23	142	1	4	3
- Heavy Heavy Duty Diesel Trucks	25	22	96	527	5	12	10
- Motorcycles (Mcy) (sub-category total)	23	22	160	4	0	0	0
- Non-Evaporative	*15*	*14*	*160*	*4*	*0*	*0*	*0*
- Evaporative	*8*	*8*	*0*	*0*	*0*	*0*	*0*
- Heavy Duty Diesel Urban Buses	3	2	9	48	0	1	1
- Heavy Duty Gas Urban Buses (sub-category total)	7	6	73	8	0	0	0
- Non-Evaporative	*7*	*6*	*73*	*8*	*0*	*0*	*0*
- Evaporative	*0*	*0*	*0*	*0*	*0*	*0*	*0*
- School Buses (sub-category total)	2	2	22	13	0	0	0
- Non-Evaporative	*1*	*1*	*19*	*1*	*0*	*0*	*0*
- Evaporative	*0*	*0*	*0*	*0*	*0*	*0*	*0*
- Diesel	*0*	*0*	*3*	*12*	*0*	*0*	*0*
- Motor Homes (sub-category total)	7	6	185	17	0	0	0
- Non-Evaporative	*7*	*6*	*185*	*14*	*0*	*0*	*0*
- Evaporative	*0*	*0*	*0*	*0*	*0*	*0*	*0*
- Diesel	*0*	*0*	*0*	*3*	*0*	*0*	*0*

* Includes directly emitted particulate matter only.

Table 2-2 (continued)

2002 Statewide Emission Inventory by Sub-Category

Division Major Category Sub-Category	TOG	ROG	CO	NOx	SOx	PM_{10}*	$PM_{2.5}$*
	Emissions (tons/day, annual average)						
Mobile Sources (division total) (continued)							
Other Mobile Sources (major category total)	511	467	2730	966	75	70	64
- Aircraft	50	45	263	56	3	9	9
- Trains	7	7	23	132	7	3	3
- Ships And Commercial Boats	9	8	21	115	64	9	9
- Recreational Boats	134	124	676	25	1	7	6
- Off-Road Recreational Vehicles (sub-category total)	54	50	254	4	0	0	0
- Snowmobiles	*45*	*42*	*133*	*3*	*0*	*0*	*0*
- Motorcycles	*3*	*3*	*45*	*0*	*0*	*0*	*0*
- All-Terrain Vehicles	*3*	*3*	*42*	*0*	*0*	*0*	*0*
- Four-Wheel Drive Vehicles	*3*	*3*	*35*	*1*	*0*	*0*	*0*
- Off-Road Equipment (sub-category total)	153	134	1359	493	1	32	29
- Lawn And Garden Equipment	*56*	*53*	*419*	*10*	*0*	*1*	*1*
- Commercial & Industrial Equipment	*97*	*81*	*940*	*483*	*1*	*31*	*28*
- Farm Equipment	22	20	134	142	0	9	9
- Fuel Storage and Handling	80	80	-	-	-	-	-
Natural (Non-Anthropogenic) Sources (division total)	**106**	**38**	**409**	**18**	**0**	**80**	**71**
Natural Sources** (major category total)	106	38	409	18	0	80	71
- Geogenic Sources	79	23	-	-	-	-	-
- Wildfires	27	15	409	18	-	80	71
Total Statewide - All Sources	***6198***	***2680***	***15036***	***3415***	***228***	***2206***	***839***

* Includes directly emitted particulate matter only.
**Does not include biogenic sources. These summaries do not include emissions from wind blown dust - exposed lake beds from Owens and Mono Lakes. These emissions are estimated to be about 800 tons/day.

Table 2-2 (continued)

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Ozone

2002 Statewide Emission Inventory - Ozone Precursors by Category

NO_x Sources - Statewide

NO_x is a group of gaseous compounds of nitrogen and oxygen, many of which contribute to the formation of ozone, PM_{10}, and $PM_{2.5}$. Most NO_x emissions are produced by the combustion of fuels. Industrial sources report NO_x emissions to local air districts and to the Air Resources Board. Other sources of NO_x emissions are estimated by the local air districts and the ARB. Mobile sources (including on-road and other) make up about 80 percent of the total statewide NO_x emissions. The category of other mobile sources includes emissions from aircraft, trains, ships, recreational boats, industrial and construction equipment, farm equipment, off-road recreational vehicles, and other equipment. Stationary sources of NO_x include both internal and external combustion processes in industries such as manufacturing, food processing, electric utilities, and petroleum refining. Area-wide sources, which include residential fuel combustion, waste burning, and fires, contribute only a small portion of the total NO_x emissions.

NO_x Emissions (annual average)		
Emissions Source	**tons/day**	**Percent**
Stationary Sources	610	18%
Area-wide Sources	93	3%
On-Road Mobile	1728	51%
Gasoline Vehicles	983	29%
Diesel Vehicles	745	22%
Other Mobile	966	28%
Total Statewide	*3397*	*100%*

Table 2-3

ROG Sources - Statewide

Reactive organic gases (ROG) are volatile organic compounds that are photochemically reactive and contribute to the formation of ozone, as well as PM_{10} and $PM_{2.5}$. These emissions result primarily from incomplete fuel combustion and the evaporation of chemical solvents and fuels. On-road mobile sources are the largest contributors to statewide ROG emissions. This category includes emissions from cars, trucks, and motorcycles powered by gasoline and diesel fuels. Stationary sources of ROG emissions include processes that use solvents (such as dry cleaning, degreasing, and coating operations) and petroleum-related processes (such as petroleum refining and marketing and oil and gas extraction). Area-wide ROG sources include consumer products, pesticides, aerosol and architectural coatings, asphalt paving and roofing, and other evaporative emissions.

ROG Emissions (annual average)		
Emissions Source	**tons/day**	**Percent**
Stationary Sources	538	20%
Area-wide Sources	698	26%
On-Road Mobile	938	36%
Gasoline Vehicles	909	34%
Diesel Vehicles	30	1%
Other Mobile	467	18%
Total Statewide	*2642*	*100%*

Table 2-4

Largest Stationary Sources Statewide

Largest Stationary Sources of NO_x Statewide

Air Basin	Facility Name	City	Tons/Year
Mojave Desert	Cemex-California Cement	Apple Valley	4640
Mojave Desert	Riverside Cement Co.	Oro Grande	4315
Mojave Desert	Cal Portland Cement Co.	Mojave	3279
San Francisco Bay Area	Martinez Refining Company	Martinez	3187
San Francisco Bay Area	Exxon Mobil Refining And Supply	Benicia	2927
North Central Coast	Duke Energy	Moss Landing	2831
San Francisco Bay Area	Chevron Products Co.	Richmond	2312
Mojave Desert	Mitsubishi Cement	Lucerne Valley	2245
San Francisco Bay Area	Ultramar, Inc. Avon Refinery	Martinez	2239
Mojave Desert	IMC Chemicals, Inc.	Trona	1948

Facility totals are the most recent available data. Some facilities may have reduced or increased emissions since these data were collected. These changes will be reflected in subsequent almanacs.
The list of facilities does not include military bases, landfills, or airports.

Table 2-5

Largest Stationary Sources of ROG Statewide

Air Basin	Facility Name	City	Tons/Year
San Francisco Bay Area	Chevron Products Co.	Richmond	2143
San Francisco Bay Area	Ultramar, Inc. Avon Refinery	Martinez	1824
San Francisco Bay Area	Martinez Refining Company	Martinez	1633
San Joaquin Valley	Occidental Petroleum	Tupman	1233
South Coast	Chevron Products Co.	El Segundo	760
South Coast	Mobil Oil Corp.	Torrance	641
San Joaquin Valley	SC Johnson Home Storage Inc	Fresno	620
Sacramento Valley	Sierra Pacific Industries (Wood Products)	Red Bluff	597
San Francisco Bay Area	Phillips 66 Company	Rodeo	567
San Francisco Bay Area	New United Motor Manufacturing	Fremont	511

Facility totals are the most recent available data. Some facilities may have reduced or increased emissions since these data were collected. These changes will be reflected in subsequent almanacs.
The list of facilities does not include military bases, landfills, or airports.

Table 2-6

Ozone - 2001 Air Quality

Air quality, as it relates to ozone, has improved greatly in California over the last several decades, and 2001 was no exception. However, despite aggressive emission controls, maximum measured ozone concentrations are still above the level of the State standard in 12 of the 15 air basins. Maximum measured values exceed the national 1-hour standard in nine air basins. California's highest ozone concentrations occur in the South Coast Air Basin, where the peak 1-hour indicator is close to two times the level of the State standard.

Ozone concentrations are generally lower near the coast than they are inland, and rural areas tend to be cleaner than urban areas. This can be explained in part by the characteristics of ozone, including pollutant reactivity, transport, and deposition. Based on current ozone concentrations, substantial additional emission control measures will be needed to attain the standards throughout the State.

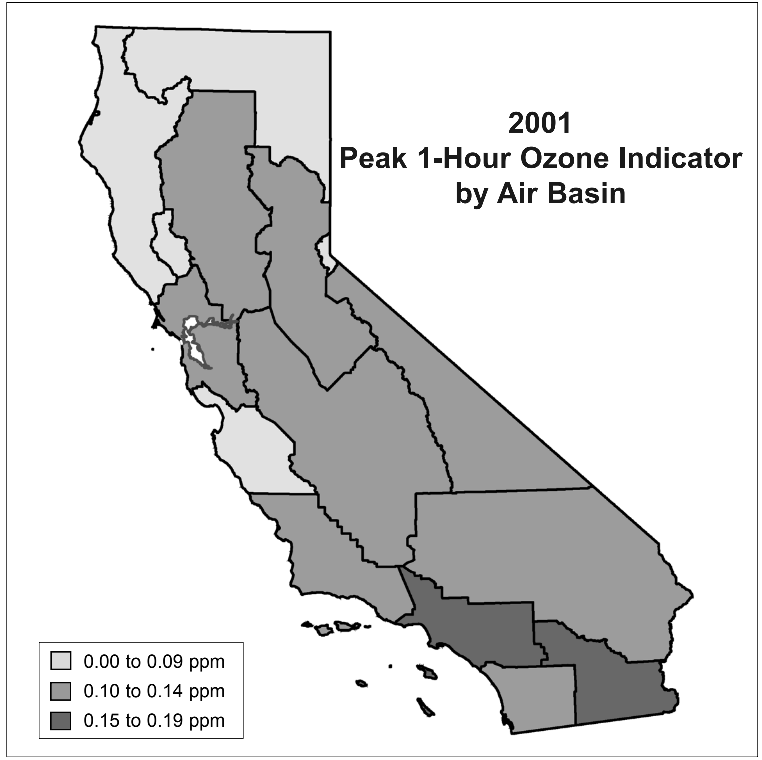

Figure 2-3

Ozone - 2001 Air Quality Tables

Maximum Peak 1-Hour Indicator by Air Basin

AIR BASIN	2001 Maximum Peak 1-Hour Indicator in parts per million	Number of Days in 2001 above State Standard	Number of Days in 2001 above National 1-Hour Standard
Great Basin Valleys Air Basin	0.11	4	0
Lake County Air Basin	0.08	0	0
Lake Tahoe Air Basin	0.09	1	0
Mojave Desert Air Basin	0.14	72	6
Mountain Counties Air Basin	0.14	49	1
North Central Coast Air Basin	0.10	3	0
North Coast Air Basin	0.09	0	0
Northeast Plateau Air Basin	0.09	0	0
Sacramento Valley Air Basin	0.14	46	2
Salton Sea Air Basin	0.16	81	15
San Diego Air Basin	0.12	29	2
San Francisco Bay Area Air Basin	0.12	15	1
San Joaquin Valley Air Basin	0.15	123	32
South Central Coast Air Basin	0.13	34	2
South Coast Air Basin	0.17	121	36

Table 2-7

Top Sites with Peak 1-Hour Indicator Values above the State Ozone Standard

Great Basin Valleys Air Basin
- Mammoth Lakes-Gateway HC

Mojave Desert Air Basin
- Hesperia-Olive Street.
- Phelan-Beekley Rd. & Phelan Rd.
- Lancaster-W Pondera Street
- Victorville-14306 Park Avenue
- Joshua Tree-National Monument

Mountain Counties Air Basin
- Cool-Highway 193
- Placerville-Gold Nugget Way
- San Andreas-Gold Strike Road
- Grass Valley-Litton Building
- Jackson-Clinton Road

North Central Coast Air Basin
- Pinnacles National Monument
- Hollister-Fairview Road

North Coast Air Basin
- Healdsburg-Municipal Airport

Sacramento Valley Air Basin
- Sloughhouse
- Folsom-Natoma Street
- Roseville-N Sunrise Blvd.
- Auburn-Dewitt C Avenue
- Rocklin-Rocklin Road

Salton Sea Air Basin
- Calexico-Ethel Street
- Calexico-Grant Street
- Palm Springs-Fire Station
- El Centro-9th Street
- Calexico-East

San Diego Air Basin
- Alpine-Victoria Drive
- San Diego-Overland Avenue
- Escondido-East Valley Parkway
- El Cajon-Redwood Avenue
- Chula Vista

San Francisco Bay Area Air Basin
- Livermore-793 Rincon Avenue
- San Martin-Murphy Avenue
- Concord-2975 Treat Blvd.
- Fairfield-Bay Area AQMD
- Hayward-La Mesa

San Joaquin Valley Air Basin
- Parlier
- Clovis-North Villa Avenue
- Arvin-Bear Mountain Blvd.
- Fresno-Sierra Parkway #2
- Fresno-1st Street

Table 2-8

Top Sites with Peak 1-Hour Indicator Values above the State Ozone Standard

South Central Coast Air Basin

- Simi Valley-Cochran Street
- Piru-3301 Pacific Avenue
- Ojai-Ojai Avenue
- Thousand Oaks-Moorpark Road
- Ventura County-W Casitas Pass Rd.

South Coast Air Basin

- Crestline
- Glendora-Laurel
- Upland
- Fontana-Arrow Highway
- Santa Clarita

Sites with 1-hour peak indicator values above the level of the State ozone standard during 2001. The top five sites in each air basin are listed in descending order of their peak indicator value. If an air basin is not listed, the peak indicator values at sites in that air basin were not above the State ozone standard.

Table 2-8 (continued)

2002 Preliminary Ozone Data

Although ozone concentrations are monitored continuously at the air quality monitoring sites, there is a delay between the time the concentrations are measured and the time they are quality assured and approved for final use. Because 2001 is the last year for which complete and approved data are available, that is the end year used for the air quality trends in this almanac. However, preliminary data for January through October 2002 are available and are summarized in Table 2-9.

Table 2-9 includes several statistics, including the maximum measured 1-hour ozone concentration, the number of days above the State ozone standard, and the number of days above both the national 1-hour and the national 8-hour ozone standards. These statistics are summarized for the five most populated areas of California: South Coast Air Basin, San Francisco Bay Area Air Basin, San Joaquin Valley Air Basin, San Diego Air Basin, and Sacramento Metro Area (the southern, urbanized portion of the Sacramento Valley Air Basin). Because data for all of 2002 were not complete at the time this almanac was published, no annual statistics are included. Furthermore, because the statistics are based on preliminary data, they are subject to change.

Several areas of the State had higher ozone values in 2002 as compared with 2001. Analyses show that meteorology played a substantial role in two of these areas: the South Coast area and the Sacramento Metro Area. The South Coast experienced stronger and longer lasting inversions, while the Sacramento Metro Area had temperatures that were much higher than normal. Both conditions are conducive to ozone formation.

Area	Maximum 1-Hour Concentration (ppm)	Days Exceeding the Standard		
		State 1-Hour	National 1-Hour	National 8-Hour
South Coast	0.17	119	47	98
San Francisco Bay Area	0.16	16	2	7
San Joaquin Valley	0.16	125	33	124
San Diego	0.12	15	0	13
Sacramento Metro Area	0.16	57	10	44

Table 2-9

The Nature of Particulate Matter (PM_{10} and $PM_{2.5}$)

PM_{10} is a mixture of particles and droplets that vary in size and chemical composition, depending on each particle's origin. PM_{10} includes the subsets of "coarse" particles, those between 2.5 microns and 10 microns in diameter ($PM_{2.5\text{-}10}$), and "fine" particles, those 2.5 microns or smaller ($PM_{2.5}$). Particulate matter can be directly emitted into the air in the form of dust and soot (primary PM) or, similar to ozone, it can be formed in the atmosphere from the reaction of gaseous precursors such as NO_x, SO_x, ROG, and ammonia (secondary PM). Primary particles are mostly coarse in size, but include some fine particles, while secondary particles are mostly fine.

Sources of ambient PM include: combustion sources such as trucks and passenger cars, off-road equipment, industrial processes, residential wood burning, and forest/agricultural burning; fugitive dust from paved and unpaved roads, construction, mining, and agricultural activities; and ammonia sources such as livestock operations, fertilizer application, and motor vehicles. In general, combustion processes emit and form fine particles, whereas particles from dust sources tend to fall in the coarse range.

The levels and chemical make-up of ambient PM vary widely from one area to another. In some areas, PM levels vary strongly by season. This is due to seasonal activity increase for some emissions sources and to weather conditions that are conducive to the build-up of PM. Seasonal sources of PM include wildfires, agricultural processes, dust storms, and residential wood burning. Stagnant conditions and cool temperatures during the winter contribute to the formation of secondary ammonium nitrate and ammonium sulfate, leading to higher ambient $PM_{2.5}$ concentrations. Dry weather and windy conditions cause higher coarse PM emissions, resulting in elevated PM_{10} concentrations.

The remainder of this chapter includes summary emission inventory data for directly emitted PM_{10} and $PM_{2.5}$, summary information on ambient PM_{10} and $PM_{2.5}$ concentrations, and description of the link between source emissions and ambient PM concentrations in selected regions of the State, highlighting two different seasonal scenarios in PM levels.

Directly Emitted Particulate Matter (PM_{10})

2002 Statewide Emission Inventory - Directly Emitted PM_{10} by Category

The PM_{10} emission inventory includes only directly emitted particulate emissions. However, particulate matter can also be formed in the atmosphere. This secondary PM_{10} is formed by reactions that are driven by emissions of ROG, NO_x, and SO_x. In urban areas (or on a seasonal basis), secondary particulate matter may be the dominant contributor to PM_{10} levels. As a result, PM_{10} control strategies need to account for the relative contribution of both secondary and directly emitted particles.

Area-wide sources account for about 88 percent of the statewide emissions of directly emitted PM_{10}. The major area-wide source of PM_{10} is fugitive dust, especially dust from unpaved and paved roads, agricultural operations, and construction and demolition. Fugitive dust emissions from unpaved and paved roads are related to motor vehicle population levels due to vehicular travel on both types of roads. Other sources of PM_{10} emissions include brake and tire wear, residential wood burning, and industrial sources. Exhaust emissions from mobile sources contribute a relatively small portion of directly emitted PM_{10} emissions and are a major source of the ROG and NO_x that form secondary particles. The section titled *PM_{10} and $PM_{2.5}$ - Linking Emission Sources with Air Quality* describes how emissions from specific sources are linked to measured PM_{10} levels

Directly Emitted PM10 Emissions (annual average)		
Emissions Source	**tons/day**	**Percent**
Stationary Sources	135	6%
Area-wide Sources	1873	88%
On-Road Mobile	48	2%
Gasoline Vehicles	30	1%
Diesel Vehicles	18	1%
Other Mobile	70	3%
Total Statewide	*2126*	*100%*

Table 2-10

Largest Stationary Sources Statewide

Largest Stationary Sources of Directly Emitted PM_{10} Statewide

Air Basin	Facility Name	City	Tons/Year
Mojave Desert	National Cement Co	Lebec	756
Mojave Desert	Mitsubishi Cement	Lucerne Valley	553
Mojave Desert	Cemex-California Cement	Apple Valley	544
Mojave Desert	U.S. Borax	Boron	539
Mountain Counties	Sierrapine Ltd., Ampine Division (Wood Products)	Martell	482
Mojave Desert	Calaveras Cement Co.	Monolith	406
Mojave Desert	IMC Chemicals, Inc.	Trona	374
San Francisco Bay Area	Martinez Refining Company	Martinez	354
San Joaquin Valley	Texaco Inc.	Kern County	326
Mojave Desert	Riverside Cement Co.	Oro Grande	312

Facility totals are the most recent available data. Some facilities may have reduced or increased emissions since these data were collected. These changes will be reflected in subsequent almanacs.
The list of facilities does not include military bases, landfills, or airports.

Table 2-11

Directly Emitted Particulate Matter ($PM_{2.5}$)

2002 Statewide Emission Inventory - Directly Emitted $PM_{2.5}$ by Category

The $PM_{2.5}$ emission inventory includes only directly emitted particulate emissions. However, particulate matter can also be formed in the atmosphere. This secondary $PM_{2.5}$ is formed by reactions that are driven by emissions of ROG, NO_x, and SO_x. In urban areas (or on a seasonal basis), secondary particulate matter may be the dominant contributor to $PM_{2.5}$ levels. As a result, $PM_{2.5}$ control strategies need to account for the relative contribution of both secondary and directly emitted particles.

Area-wide sources account for about 76 percent of the statewide emissions of directly emitted $PM_{2.5}$. The major area-wide source of $PM_{2.5}$ is fugitive dust, especially dust from unpaved and paved roads, agricultural operations, and construction and demolition. Fugitive dust emissions from unpaved and paved roads are related to motor vehicle population levels due to vehicular travel on both types of roads. Other sources of $PM_{2.5}$ emissions include brake and tire wear, residential wood burning, and industrial sources. Exhaust emissions from mobile sources contribute only a very small portion of directly emitted $PM_{2.5}$ emissions, but are a major source of the ROG and NO_x that form secondary particles. The section titled *PM_{10} and $PM_{2.5}$ - Linking Emission Sources with Air Quality* describes how emissions from specific sources are linked to measured $PM_{2.5}$ levels

Directly Emitted PM2.5 Emissions (annual average)		
Emissions Source	**tons/day**	**Percent**
Stationary Sources	88	11%
Area-wide Sources	583	76%
On-Road Mobile	33	4%
Gasoline Vehicles	18	2%
Diesel Vehicles	15	2%
Other Mobile	64	8%
Total Statewide	*768*	*100%*

Table 2-12

Largest Stationary Sources Statewide

Largest Stationary Sources of Directly Emitted $PM_{2.5}$ Statewide

Air Basin	Facility Name	City	Tons/Year
Mountain Counties	Sierrapine Ltd., Ampine Division (Wood Products)	Martell	385
Mojave Desert	Mitsubishi Cement	Lucerne Valley	377
Mojave Desert	Cemex-California Cement	Apple Valley	360
San Francisco Bay Area	Martinez Refining Company	Martinez	342
San Joaquin Valley	Texaco Inc.	Kern County	326
North Central Coast	Duke Energy	Moss Landing	292
Mojave Desert	National Cement Co	Lebec	241
South Coast	Chevron Products Co.	El Segundo	228
Sacramento Valley	Johns-Manville (Insulation)	Willows	220
San Diego	Cabrillo Power Inc.	Carlsbad	216

Facility totals are the most recent available data. Some facilities may have reduced or increased emissions since these data were collected. These changes will be reflected in subsequent almanacs.
The list of facilities does not include military bases, landfills, or airports.

Table 2-13

PM_{10} - 2001 Air Quality

Most areas of California have either 24-hour or annual PM_{10} concentrations that exceed the State standards. Some areas exceed both State standards. Several areas, both urban and rural, also exceed the national standards. The highest annual average values during 2001 occurred in the Salton Sea, Great Basin Valleys, and South Coast Air Basins. The highest 24-hour concentrations generally occurred in the desert areas where wind-blown dust contributes to local PM_{10} problems.

Particles resulting from combustion contribute to high PM_{10} in a number of urban areas. While many of the control programs implemented for ozone will also reduce PM_{10}, more controls specifically for PM_{10} will be needed to reach attainment.

PM_{10} - 2001 Air Quality Tables

Maximum 24-Hour and Annual PM_{10} Concentrations by Air Basin

AIR BASIN	2001 Maximum 24-Hour Concentration in micrograms/cubic meter	2001 Maximum Annual Average of Quarters in micrograms/cubic meter
Great Basin Valleys Air Basin	4482	69.8
Lake County Air Basin	21	7.6
Lake Tahoe Air Basin	58	19.8
Mojave Desert Air Basin	115	29.8
Mountain Counties Air Basin	312	33.3
North Central Coast Air Basin	72	29.4
North Coast Air Basin	73	24.1
Northeast Plateau Air Basin	105	25.1
Sacramento Valley Air Basin	105	30.2
Salton Sea Air Basin	647	86.2
San Diego Air Basin	107	49.1
San Francisco Bay Area Air Basin	109	28.9
San Joaquin Valley Air Basin	205	57.4
South Central Coast Air Basin	152	44.4
South Coast Air Basin	219	63.3

Table 2-14

Top Sites with 24-Hour Concentrations above the State PM_{10} Standard

Great Basin Valleys Air Basin
- Shell Cut-Highway 190
- Flat Rock-Highway 190
- Mammoth Lakes-Gateway HC
- Lee Vining-SMS
- Keeler-Cerro Gordo Road

Lake Tahoe Air Basin
- South Lake Tahoe-Sandy Way

Mojave Desert Air Basin
- China Lake-Powerline Road
- San Jacinto-San Jacinto Street
- Twentynine Palms-Adobe Rd. #2
- San Jacinto-Young Street
- Ridgecrest-100 W. California Ave.

Mountain Counties Air Basin
- Yosemite Village-Visitor Center
- Quincy-North Church Street
- Placerville-Gold Nugget Way

North Central Coast Air Basin
- Davenport
- Moss Landing-Sandholt Road
- King City-750 Metz Road

North Coast Air Basin
- Weaverville-Courthouse
- Eureka-Health Dept 6th & I Street
- Fort Bragg-North Franklin Street
- Guerneville-Church & 1st
- Cloverdale

Northeast Plateau Air Basin
- Susanville-Russell

Sacramento Valley Air Basin
- Chico-Manzanita Avenue
- West Sacramento-15th Street
- Sacramento-T Street
- Yuba City-Almond Street
- Vacaville-Merchant Street

Salton Sea Air Basin
- Westmoreland-West 1st Street
- Indio-Jackson Street
- Calexico-Grant Street
- Calexico-Ethel Street
- Palm Springs-Fire Station

San Diego Air Basin
- Otay Mesa-Paseo International
- El Cajon-Redwood Avenue
- Escondido-East Valley Parkway
- San Diego-12th Avenue
- Chula Vista

San Francisco Bay Area Air Basin
- Livermore-793 Rincon Avenue
- Concord-2975 Treat Blvd.
- Pittsburg-10th Street
- Napa-Jefferson Avenue
- Vallejo-304 Tuolumne Street

Table 2-15

Top Sites with 24-Hour Concentrations above the State PM_{10} Standard

San Joaquin Valley Air Basin

- Bakersfield-Golden State Highway
- Fresno-1st Street
- Bakersfield-5558 California Avenue
- Hanford-South Irwin Street
- Modesto-14th Street
- Oildale-3311 Manor Street

South Central Coast Air Basin

- Arroyo Grande-Ralcoa Way
- Nipomo-Guadalupe Road
- Simi Valley-Cochran Street
- Santa Maria-906 South Broadway
- Paso Robles-Santa Fe Avenue

South Coast Air Basin

- Banning Airport
- Ontario-1408 Francis Street
- Riverside-Rubidoux
- Norco-Norconian
- San Bernardino-4th Street
- Fontana-Arrow Highway
- Azusa

Sites with 24-hour PM_{10} concentrations above the level of the State PM_{10} standard during 2001. The top five sites in each air basin are listed in descending order of their maximum 24-hour concentration. If an air basin is not listed, the 24-hour PM_{10} concentrations at sites in that air basin were not above the State 24-hour PM_{10} standard. If more than 5 sites are listed, there were multiple sites with the same maximum concentration.

Table 2-15 (continued)

$PM_{2.5}$ Air Quality

As explained in the Introduction section of Chapter 1, the U.S. EPA promulgated new national standards (24-hour and annual average) for $PM_{2.5}$ in July 1997. In June 2002, the ARB established a new, more health-protective State annual average $PM_{2.5}$ standard. The installation of federally approved $PM_{2.5}$ mass monitors throughout California began in 1998 and is now complete, with monitors at 81 sites. Detailed information on California's $PM_{2.5}$ network can be found on the ARB website at: *www.arb.ca.gov/aqd/pm25/pmfnet01.htm*.

The majority of sites in California's $PM_{2.5}$ network began sampling in early 1999. The 1999, 2000, and 2001 data are summarized in Table 2-16. For each air basin and each year, Table 2-16 lists the highest 24-hour average $PM_{2.5}$ mass concentration, the maximum 98th percentile 24-hour concentration, an indication of the 98th percentile validity, the maximum annual average of quarters (annual average), and an indication of the annual average validity. Validity is based on the number of measurements available per quarter. Sites in the South Coast and San Joaquin Valley Air Basins recorded the highest 24-hour concentrations, valid 98th percentile 24-hour concentrations, and valid annual average concentrations in the State. The annual averages for these areas were about twice the level of the State annual $PM_{2.5}$ standard.

Three years of complete data are required to make comparisons to the national $PM_{2.5}$ standards. However, many areas do not yet have sufficient data to make these comparisons. Although three years of complete data are also required to determine if an area attains the new State $PM_{2.5}$ standard, data showing exceedances of the standard are sufficient to determine that an area does not attain the standard.

$PM_{2.5}$ Air Quality Data

Air Basin*	Year	Maximum 24-Hour Concentration (µg/m^3)	98th Percentile 24-Hour Concentration (µg/m3)**	98th Percentile Concentration Valid?**	Average of Quarters (µg/m^3)**	Average of Quarters Valid?**
Great Basin Valleys	1999	40.7	30.9	N	7.2	N
	2000	68.0	67.0	Y	18.0	N
	2001	76.0	41.0	N	10.3	N
Lake County	1999	14.5	14.5	N	4.3	N
	2000	9.4	9.4	N	4.0	N
	2001	15.1	11.3	Y	4.2	Y
Lake Tahoe	1999	21.0	21.0	Y	8.3	Y
	2000	23.0	21.0	Y	7.8	Y
	2001	31.0	26.0	Y	8.2	Y
Mojave Desert	1999	47.6	23.5	Y	11.9	Y
	2000	38.6	26.4	N	11.9	Y
	2001	35.0	29.0	N	11.5	Y
Mountain Counties	1999	92.0	84.0	Y	13.3	N
	2000	48.0	44.0	N	10.6	N
	2001	120.0	43.0	Y	15.6	Y
North Central Coast	1999	31.4	23.6	N	9.8	N
	2000	26.4	21.5	N	7.9	N
	2001	25.6	23.1	N	9.1	N

* The table lists the highest value for each statistic. Within an air basin, the highest value for each statistic may reflect a different site.
** These statistics and determination of their validity are calculated according to the methods specified in 40 CFR Part 50, Appendix N. Validity is based on the number of measurements available per quarter and therefore, depends on data completeness. Both the 98th percentile concentration and the average of quarters concentration relate to the national $PM_{2.5}$ standards, while only the average of quarters concentration relates to the State $PM_{2.5}$ standard.

Table 2-16

$PM_{2.5}$ Air Quality Data

Air Basin*	Year	Maximum 24-Hour Concentration (µg/m³)	98th Percentile 24-Hour Concentration (µg/m³)**	98th Percentile Concentration Valid?**	Average of Quarters (µg/m³)**	Average of Quarters Valid?**
North Coast	1999	36.9	27.7	Y	9.1	Y
	2000	24.0	21.5	Y	9.1	Y
	2001	38.3	29.0	Y	9.4	Y
Northeast Plateau	1999	40.0	27.0	Y	7.9	Y
	2000	38.0	37.0	Y	8.5	Y
	2001	35.0	35.0	N	7.6	N
Sacramento Valley	1999	108.0	71.0	Y	23.7	N
	2000	98.0	70.0	Y	15.8	Y
	2001	72.0	56.0	Y	13.0	Y
Salton Sea	1999	52.5	43.2	N	15.2	Y
	2000	84.2	56.0	Y	16.9	Y
	2001	60.2	50.4	N	14.9	N
San Diego	1999	64.3	45.1	N	18.0	Y
	2000	66.3	48.7	N	15.8	Y
	2001	60.0	40.8	Y	17.7	Y
San Francisco Bay Area	1999	90.5	53.8	N	28.1	N
	2000	67.2	55.3	Y	13.6	Y
	2001	107.5	56.0	Y	12.5	Y

* The table lists the highest value for each statistic. Within an air basin, the highest value for each statistic may reflect a different site.
** These statistics and determination of their validity are calculated according to the methods specified in 40 CFR Part 50, Appendix N. Validity is based on the number of measurements available per quarter and therefore, depends on data completeness. Both the 98th percentile concentration and the average of quarters concentration relate to the national $PM_{2.5}$ standards, while only the average of quarters concentration relates to the State $PM_{2.5}$ standard.

Table 2-16 (continued)

$PM_{2.5}$ Air Quality Data

Air Basin*	Year	Maximum 24-Hour Concentration (µg/m³)	98th Percentile 24-Hour Concentration (µg/m³)**	98th Percentile Concentration Valid?**	Average of Quarters (µg/m³)**	Average of Quarters Valid?**
San Joaquin Valley	**1999**	**136.0**	**120.0**	**Y**	**27.7**	**Y**
	2000	**160.0**	**108.0**	**Y**	**25.5**	**N**
	2001	**154.7**	**120.6**	**Y**	**22.5**	**Y**
South Central Coast	**1999**	**64.6**	**35.4**	**Y**	**13.8**	**Y**
	2000	**55.3**	**42.4**	**N**	**14.8**	**N**
	2001	**57.6**	**50.7**	**Y**	**14.9**	**Y**
South Coast	**1999**	**121.4**	**85.6**	**Y**	**31.0**	**Y**
	2000	**119.6**	**83.0**	**Y**	**28.3**	**Y**
	2001	**98.0**	**74.3**	**Y**	**31.0**	**Y**

* The table lists the highest value for each statistic. Within an air basin, the highest value for each statistic may reflect a different site.
** These statistics and determination of their validity are calculated according to the methods specified in 40 CFR Part 50, Appendix N. Validity is based on the number of measurements available per quarter and therefore, depends on data completeness. Both the 98th percentile concentration and the average of quarters concentration relate to the national $PM_{2.5}$ standards, while only the average of quarters concentration relates to the State $PM_{2.5}$ standard.

Table 2-16 (continued)

PM_{10} and $PM_{2.5}$ - Linking Emissions Sources with Air Quality

The size, concentration, and chemical composition of PM vary by region and by season. A number of areas exhibit strong seasonal patterns. Other areas have a much more uniform distribution with PM concentrations remaining high throughout the year. In yet other areas, isolated PM exceedances can occur at any time of the year.

In the San Joaquin Valley, the San Francisco Bay Area, and the Sacramento region, there is a strong seasonal variation in PM, with higher PM_{10} and $PM_{2.5}$ concentrations in the fall and winter months (refer to Figure 2-4). In the winter, PM_{10} and $PM_{2.5}$ concentrations remain elevated for extended periods. These higher concentrations are caused by increased activity for some emission sources and meteorological conditions that are conducive to the build-up of PM. During the winter, the $PM_{2.5}$ size fraction drives the PM concentrations, and the major contributor to high levels of ambient $PM_{2.5}$ is the secondary formation of PM caused by the reaction of NO_x and ammonium to form ammonium nitrate. The San Joaquin Valley also records high PM_{10} levels during the fall. During this season, the coarse fraction ($PM_{2.5-10}$) drives the PM concentrations.

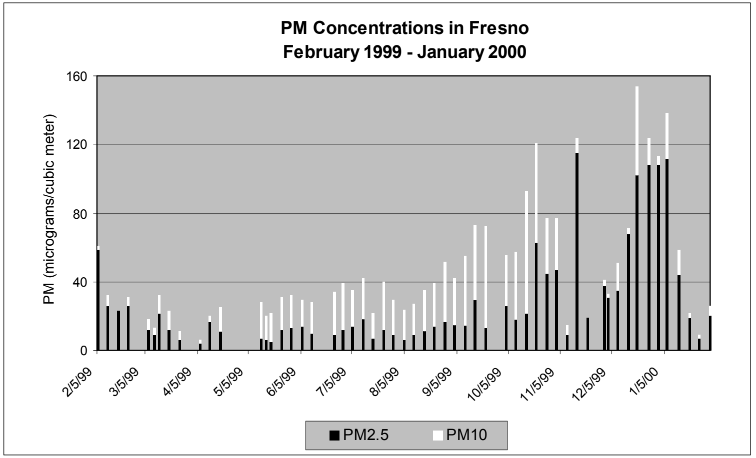

Figure 2-4

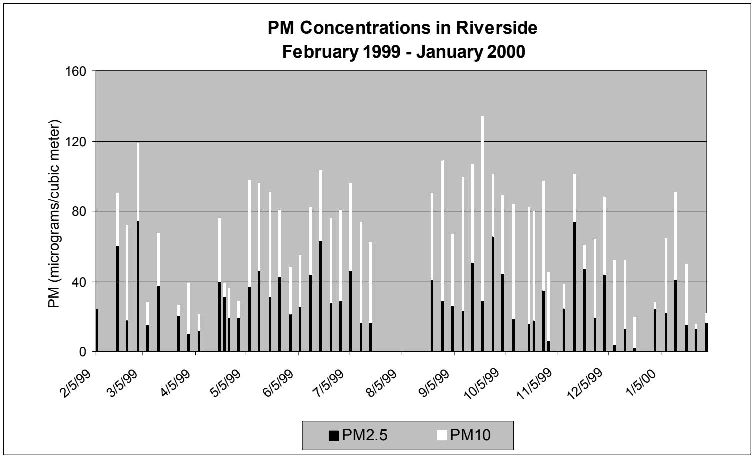

Figure 2-5

In the South Coast region, PM_{10} concentrations remain high throughout the year (refer to Figure 2-5). $PM_{2.5}$ concentrations can reach high levels in the spring, fall, and winter. The more uniform activity patterns of emission sources, as well as less variable weather patterns, leads to this more uniform concentration pattern. In other areas, high PM can be more episodic than seasonal. For example, in the Owens Lake area of the Great Basin Valleys Air Basin, episodic fugitive dust events lead to very high PM_{10} levels, with soil dust as the major contributor to ambient PM_{10}.

Chemical Mass Balance (CMB) models are used to establish which sources and how much of their emissions contribute to ambient PM concentrations. CMB models use chemical composition data from ambient PM samples and from emission sources. These data are often collected during special source attribution studies. The source attribution data presented in this section were derived from a variety of studies with differing degrees of chemical speciation. In general, however, the source categories can be interpreted in the following manner. The road and other dust, wood smoke, cooking, vehicle exhaust, and construction categories represent sources which directly emit particles. Road and other dust represents the combination of mechanically disturbed soil (paved and unpaved roads, agricultural activities) and wind-blown dust. Wood smoke generally represents residential wood combustion, but may also include combustion from other biomass burning such as agricultural or prescribed burning. The vehicle exhaust category represents direct motor vehicle exhaust particles from both gasoline and diesel vehicles. Construction reflects construction and demolition activities. Ammonium nitrate and ammonium sulfate represent secondary species (i.e., they form in the atmosphere from the emissions of nitrogen oxides (NO_x), sulfur oxides (SO_x), and ammonia). Combustion sources, such as motor vehicles and stationary sources, contribute to the NO_x that forms ammonium nitrate. Mobile sources such as diesel vehicles, locomotives, and ships and stationary combustion sources emit the SO_x that forms ammonium sulfate. Ammonia sources include animal feedlots, fertilizers, and motor vehicles. The other carbon sources category reflects organic sources not included in the source attribution models, such as natural gas combustion, as well as secondary organic carbon formation. The unidentified category represents the mass that cannot be accounted for by the identified source categories. It can include particle-bound water, as well as other unidentified sources.

The figures on the following pages present the best available source attribution data from CMB modeling for selected regions, which highlight two seasonal scenarios. These presentations are representative of typical days when the State PM_{10} standards are exceeded (refer to Chapter 1, for a review of the State standards). The fractions of the constituents shown can vary daily and from year to year, depending on factors such as meteorology.

San Joaquin Valley Air Basin

Figures 2-6 and 2-7 illustrate source contributions to ambient PM in the San Joaquin Valley during the fall and winter. These are the results from a detailed chemical analysis of samples collected during the 1995 Integrated Monitoring Study (Magliano et al., 1999).

In the fall, at Corcoran, elevated concentrations of PM_{10} were associated with high levels of road and agricultural dust. NO_x emissions from mobile and stationary combustion sources, combined with ammonium, led to significant secondary ammonium nitrate contributions to PM_{10}. During the winter, in Fresno, secondary ammonium nitrate was the major contributor to $PM_{2.5}$ and PM_{10}. Emissions from wood smoke, vehicle exhaust particles, and other carbon sources also contributed significantly to $PM_{2.5}$ levels.

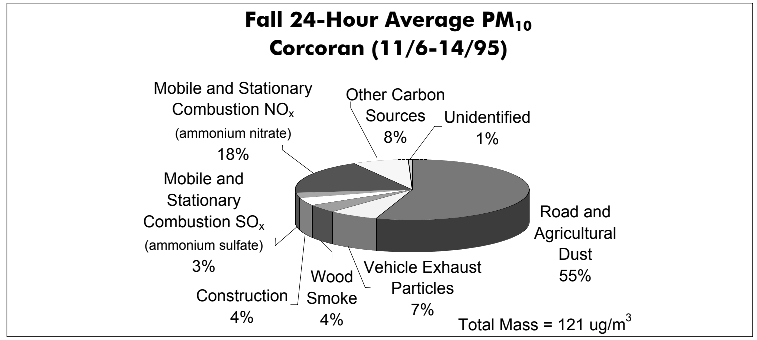

Figure 2-6

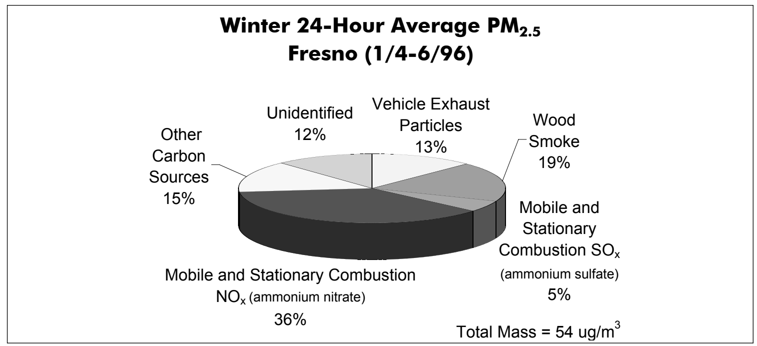

Figure 2-7

San Francisco Bay Area Air Basin

Figures 2-8 and 2-9 illustrate the sources of PM during the winter in the San Francisco Bay Area. The data are from the source apportionment analysis conducted by the Bay Area Air Quality Management District using samples collected during two special studies (Fairley, 1996, 2001).

During the winter, in San Jose, high PM concentrations are associated with high levels of wood smoke, primarily from residential wood combustion, and cooking. NO_x emitted from mobile and stationary combustion sources, in combination with ammonium, contributes about one-fourth of the PM levels. Particle emissions from mobile and stationary combustion sources are also a major contributor to $PM_{2.5}$. Road dust is a significant contributor to PM_{10}, but not $PM_{2.5}$.

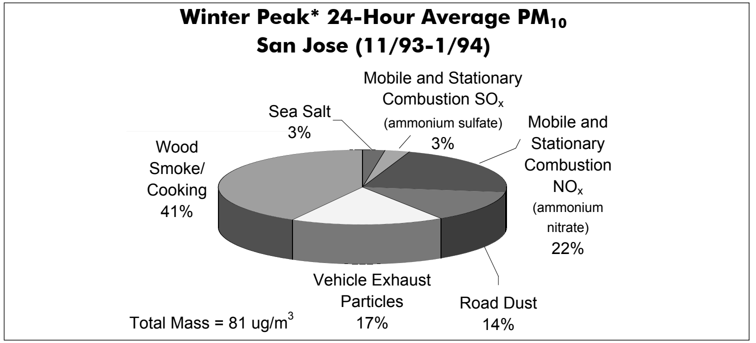

Figure 2-8 * Average of days with PM_{10} > 50 ug/m^3

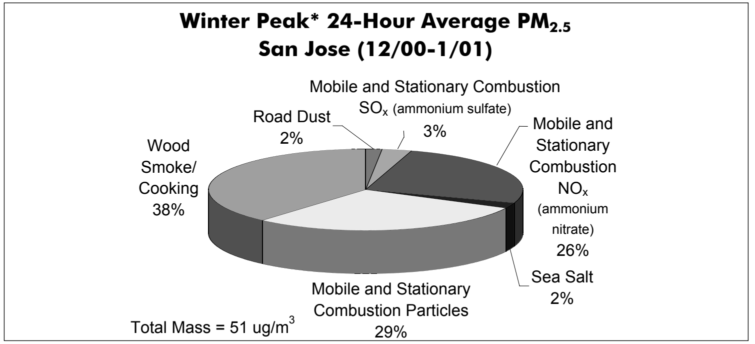

Figure 2-9 * Average of days with $PM_{2.5}$ > 40 ug/m^3

Sacramento Valley Air Basin

Figures 2-10 and 2-11 illustrate source contributions to ambient PM_{10} and $PM_{2.5}$ during the winter in Sacramento. The data are from the analysis of ambient air samples collected from November through January, during the six year period of 1991 through 1996 (Motallebi, 1999).

NO_x emissions from mobile and stationary combustion sources, combined with ammonium, contribute the most to ambient PM levels. Vehicle exhaust particle emissions and wood smoke from residential wood combustion also contribute significantly. While road and other dust is a significant component of ambient PM_{10}, its contribution to $PM_{2.5}$ is minor.

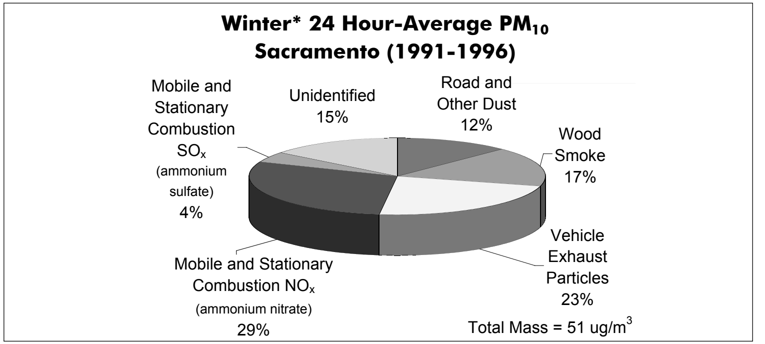

Figure 2-10 * Average of days with PM_{10} > 40 ug/m³

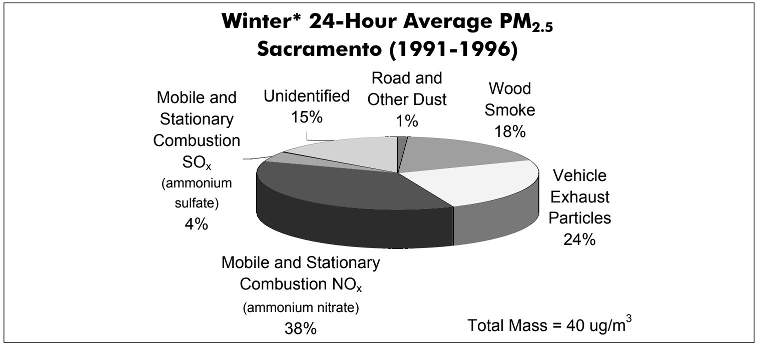

Figure 2-11 * Average of days with PM_{10} > 40 ug/m³

South Coast Air Basin

Data for Figures 2-12, 2-13, 2-14, and 2-15 are from the source apportionment analysis that the South Coast Air Quality Management District (SCAQMD) performed for the 1997 Air Quality Management Plan. SCAQMD collected samples during a one-year special study from January 1995 to February 1996, as part of the PM_{10} Technical Enhancement Program (SCAQMD, 1996).

On an annual basis, in Central Los Angeles, dust from roads and construction is the major contributor to ambient PM_{10}. This is not the case for the episode on November 17, 1995. In both cases, NO_x and SO_x emitted from mobile and stationary combustion sources, combined with ammonium, contribute significantly. Vehicle exhaust particles and emissions from other carbon sources also contribute to both annual and episodic ambient PM_{10} levels.

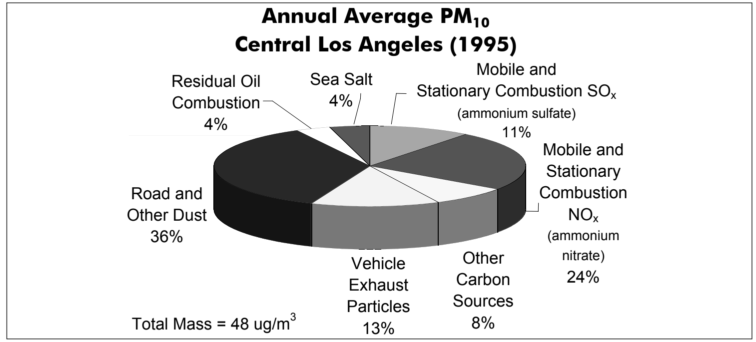

Figure 2-12

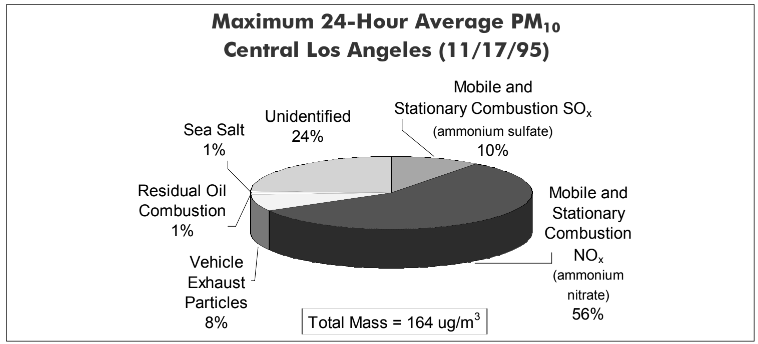

Figure 2-13

On an annual basis, in Rubidoux, dust from roads and construction is the major contributor to ambient PM_{10}. In contrast, dust was a minor contributor to the PM_{10} episode on November 17, 1995. In both cases, NO_x emitted from mobile and stationary combustion sources, combined with ammonium, contributes significantly. Vehicle exhaust particles and emissions from other carbon sources also contribute to both annual and episodic ambient PM_{10} levels.

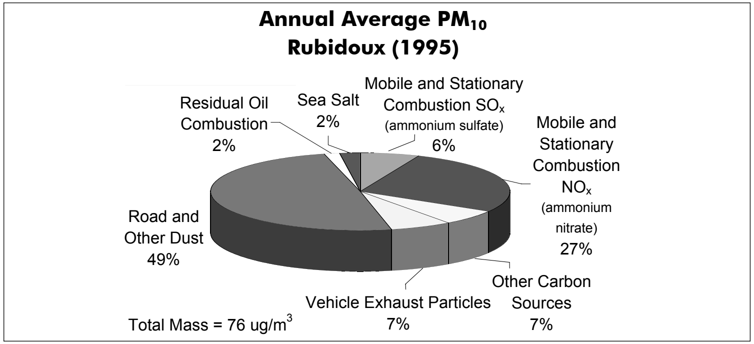

Figure 2-14

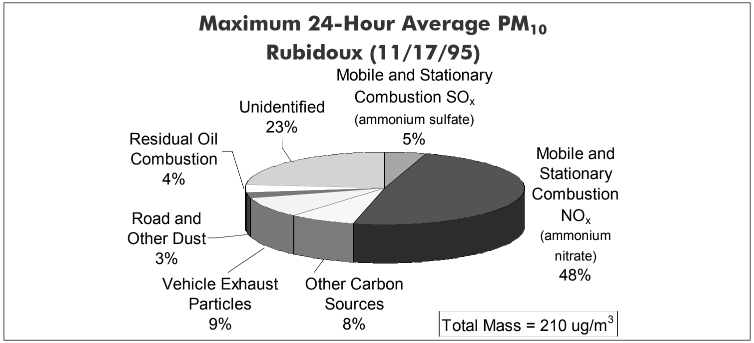

Figure 2-15

References:

Fairley, D. *Source Apportionment of Bay Area Particulates.* 1996; Personal communication.

Fairley, D. *$PM_{2.5}$ Source Apportionment for San Jose 4^{th} Street.* 2001; Personal communication.

Magliano, K. L., Hughes, V. M., Chinkin, L. R., Coe, D. L., Haste, L. T., Kumar, N., Lurmann, F. W. *Spatial and Temporal Variations in PM_{10} and $PM_{2.5}$ Source Contributions and Comparison to Emissions During the 1995 Integrated Monitoring Study.* Atmospheric Environment 1999; 33:4757-4773.

Motallebi, N. *Wintertime PM_{10} and $PM_{2.5}$ Source Apportionment at Sacramento, California.* Journal of the Air & Waste Management Association 1999; 49:PM-25-34.

South Coast Air Quality Management District. "*Modeling and Attainment Demonstrations*" in 1997 Air Quality Management Plan, Diamond Bar, California. 1996.

Carbon Monoxide
2002 Statewide Emission Inventory - Carbon Monoxide by Category

Carbon monoxide (CO) gas is formed as the result of incomplete combustion of fuels and waste materials such as gasoline, diesel fuel, wood, and agricultural debris. Mobile sources generate about 83 percent of the statewide CO emissions. Diesel-powered, on-road vehicles are small CO contributors. Stationary and area-wide sources of CO are the same types of fuel combustion sources that also generate NO_x. The stationary source contribution to statewide CO is small, due in part to widespread use of natural gas as a fuel and the presence of combustion controls.

CO Emissions (annual average)		
Emissions Source	**tons/day**	**Percent**
Stationary Sources	441	3%
Area-wide Sources	2085	14%
On-Road Mobile	9372	64%
Gasoline Vehicles	9235	63%
Diesel Vehicles	137	1%
Other Mobile	2730	19%
Total Statewide	*14628*	*100%*

Table 2-17

Carbon Monoxide - 2001 Air Quality

The State and national carbon monoxide standards are now attained in most areas of California. The requirements for cleaner vehicles and fuels have been primarily responsible for the reductions in CO, despite significant increases in population and the number of vehicle miles traveled each day. However, there are still two problem areas: a limited portion of Los Angeles County and the city of Calexico in Imperial County. While CO concentrations continue to decrease throughout most of the State, the CO problem in Calexico is unique in that this area shares a border with Mexico. There is a high likelihood that cross-border traffic contributes to the local CO problem in this area, and more study is needed to determine the most effective control strategy.

Figure 2-16

Carbon Monoxide - 2001 Air Quality Tables

Maximum Peak 8-Hour Indicator by Air Basin

AIR BASIN	2001 Maximum Peak 8-Hour Indicator in parts per million	Number of Days in 2001 above State 8-Hour Standard	Number of Days in 2001 above National 8-Hour Standard
Great Basin Valleys Air Basin	2.5	0	0
Lake County Air Basin	Incomplete Data	Incomplete Data	Incomplete Data
Lake Tahoe Air Basin	2.0	0	0
Mojave Desert Air Basin	4.8	0	0
Mountain Counties Air Basin	2.4	0	0
North Central Coast Air Basin	1.6	0	0
North Coast Air Basin	3.2	0	0
Northeast Plateau Air Basin	Incomplete Data	Incomplete Data	Incomplete Data
Sacramento Valley Air Basin	7.3	0	0
Salton Sea Air Basin	14.3	6	6
San Diego Air Basin	5.4	0	0
San Francisco Bay Area Air Basin	6.9	0	0
San Joaquin Valley Air Basin	6.4	0	0
South Central Coast Air Basin	3.1	0	0
South Coast Air Basin	11.2	0	0

Table 2-18

Sites with Peak 8-Hour Indicator Values above the State CO Standard

Salton Sea Air Basin

- Calexico-Ethel Street

South Coast Air Basin

- Lynwood

Sites with peak 8-hour indicator values above the level of the State CO standard during 2001. Sites in each air basin are listed in descending order of their 8-hour peak indicator value. If an air basin is not listed, the peak indicator values at sites in that air basin were not above the State CO standards.

Table 2-19